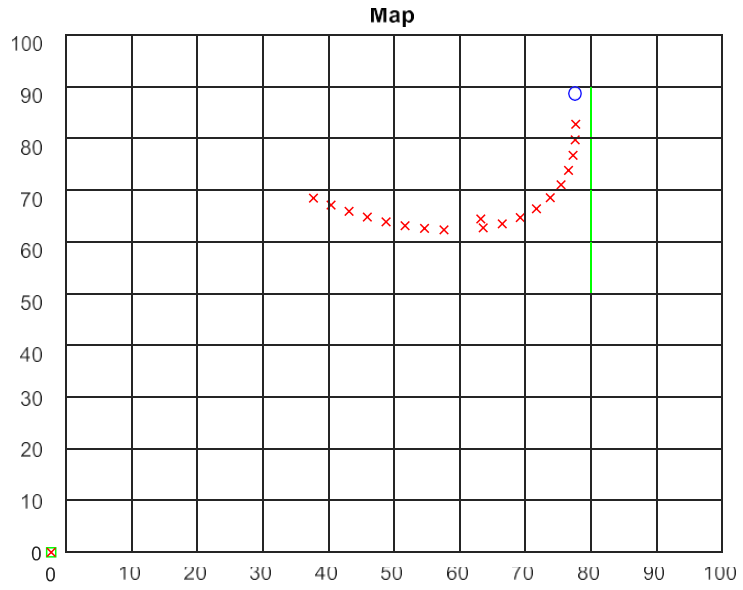
1. **(20) Problem 3 (Intelligent Agent & Propositional Logic):** Consider the following problem. A fox (intelligent agent 1) and a rabbit (intelligent agent 2) see each other at the same time. The rabbit is located a distance X meters from its hole. The fox moves with a speed of 3 m/s, the rabbit moves with a speed of 2 m/s. The rabbit bolts to its hole and the fox give chase. If the rabbit gets to the hole before the fox catches it, the rabbit wins, if not, the fox wins. The area of interest is a 100 m x 100 m field.
    a. (15) Develop and submit a MATLAB program for these two intelligent agents. The program should do the following:
        i. Accept the following inputs: Rabbit Hole Location, Initial Rabbit Location, and Initial Fox Location.
        ii. Use the following homing algorithm
            1. Advance time by 1 s increments.
            2. In each time interval
                a. The rabbit moves at full speed toward the hole
                b. The fox moves at full speed toward where the rabbit was at the end of the last time interval (i.e., it does not predict the rabbit's move).
            3. If at the end of a time interval:
                a. The rabbit is within 2 m of its hole, the rabbit wins.
                b. The fox is within 2 m of the rabbit, the fox wins.
                c. A tie goes to the fox.

        iii. Provide the following text output:
            1. Rabbit Hole Location, Initial Rabbit Location, and Initial Fox Location.
            2. Final Rabbit Location, Final Fox Location, Result (rabbit got to hole or fox caught rabbit), concluding simulation time (time for rabbit to get to hole or fox to catch rabbit).
        iv. Provide the following graphical output:
            1. The area of interest broken into 5 m x 5 m cells (with grids).
            2. The hole location designated by a black circle.
            3. The initial rabbit location designated by a blue "x"
            4. The initial fox location designated by a red box.
            5. The path taken by the rabbit (as connected black xs)
            6. The path taken by the fox (as connected black boxes)
            7. The final location of the fox designated by a green box.

        See HW_5_Fox

    b. (5) Run the simulation using the following input and provide the simulation results in your MS Word submission:
        i. Rabbit hole location: (Xrh, Yrh) = (80, 90)
        ii. Rabbit initial location: (Xr, Yr) = (80, 50)
        iii. Fox initial location: (Xf, Yf) = (40, 70)



Red x is fox, Green box is rabbit, Black circle is hole.

c. (3) Is it appropriate for the algorithm to assume that the fox does not anticipate the direction of motion of the rabbit? Provide two pros and two cons (Hint: what is one of the principal tips for simulation development).
   i. Yes and no.
   ii. Pros:
      1. Assuming no knowledge keeps it simple.
      2. The fox does not know with certainty either his or the rabbits velocity.
      3. The rabbit can easily change direction to confuse the fox, so better not to bet on the rabbit's direction.
   iii. Cons:
      1. The rabbit will most likely head to its hole.
      2. The fox may have an intuitive idea of the approximate speed of both himself and the rabbit.

d. (2) How would you improve the algorithm (i.e., the intelligence of both the rabbit and the fox)?
   i. Have the rabbit randomly change direction while generally heading toward its hole.
   ii. Provide the fox with an approximate value for both its speed and that of the rabbit to anticipate the rabbit's next location. (Note that we will consider these kinds of algorithms later in this course).